DOCUMENT RESUME

ED 162 260 CS 004 452

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TITLE Comparing Visual/Tactile Performance and Reading Achievement.
PUB DATE Oct 78
NOTE 53p.; Paper presented at the Annual Meeting of the North Central Reading Association (21st, Notre Dame, Indiana, October 20-21, 1978); Appendix C may not reproduce well

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Elementary Education; Motor Development; *Perceptual Motor Coordination; *Reading Achievement; Reading Development; Reading Failure; Reading Instruction; Reading Research; *Reading Skills; *Tactual Perception; *Visual Perception

ABSTRACT

The theory that reading is a perceptual process was tested in a study involving 216 fourth, fifth, and sixth graders. The significance of the relationship between performance on a standard reading test and on an apparatus designed to test visual/motor perception was assessed. An analysis of the data revealed that there was no relationship between performance on the reading test and on the apparatus. The data indicate that skill in reading and in visual perception are not related. (Appendixes contain a scoring sheet for the visual/motor perception instrument, class-by-class breakdowns of the findings, and tables of data analysis.) (FL)

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# COMPARING VISUAL/TACTILE PERFORMANCE

# AND

# READING ACHIEVEMENT

A

Presentation

to the

North Central Reading Association

Twenty-First Annual Conference

at the

University of Notre Dame

by
Bruce A. Lloyd, Ph.D.
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October 20 - 21, 1978

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Comparing Visual-Tactile Performance with Reading Achievement

Skill in reading is an important ingredient in the make-up of an educated citizenry living in a democratic society. One must read to remain well-informed so that subsequent citizenship responsibilities can be carried out intelligently, Moreover, the importance of being able to read well is recognized by educators, many of whom strive mightily to help their students read at a level commensurate with ability. So the importance of student reading proficiency in our modern educational endeavors is unquestioned. Most, if not all academic subjects are learned through the reading process (Heilman, 1977).

However vital reading skills are, whatever time and effort have been expended in developing and improving reading proficiency, the sad fact remains that many individuals do not read well. Educational studies show vast numbers of students to be poor readers, so much so, that those individuals do not readily benefit from their exposure to classroom reading instruction. (Spach and Spach, 1977).

The real causes of this phenomenon are not adequately known at present, but it can probably be assumed that, whatever the etiology, it is multiple rather than single. Multiple because there are so many forces at work helping or hindering the student. Proper nutrition or its lack affect the learner. The self-image whether positive or negative have an impact on the learner. Methods of reading instruction, whether visual, auditory, or motor may be suitable or not depending upon the unique learning modality of the student. (Ekwall, 1976).

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This research project was sponsored by a grant from the Faculty Research Fund of Western Michigan University, Kalamazoo, Michigan. Data analysis was made with the able assistance of Dr. Robert Brashear. Other valuable assistance was rendered by Mr. Bradley VanderVliet, the author's research associate.

And the problem has been recognized throughout the years because there are many remedies proffered for educators to use. Some are simple and some are complex. Some work well, but many procedures to eliminate the reading problem do not produce positive results, and reading deficiencies remain to plague students as they grow toward maturity (Lloyd, 1972).

Because there are so many poor readers in our society, because so many individuals do not read well, a close examination of reading theory and practice seems warranted. Yet a complete examination is to massive an undertaking so a limited seminal study was planned and carried out to test one facet of the total reading theory matrix: That is to test the assumption that reading is a perceptual process. Perhaps the perceptual theory is incorrect and because too much perceptual instruction is given, this is why there are so many poor readers.

Introduction. As one ponders the problem initially, it may appear to be true that reading is indeed a perceptual process. We know that a reader needs to visually perceive the print on a page and, concurrently, decode the graphic representations of the author's thoughts. So far the typical individual, reading is a visual-perceptual process, although there is much more to reading than that. It is also a process of auditory perception and discrimination because decoding requires the association of sounds with symbols and the learning of the phoneme-grapheme relationships needed to read. But it would appear that visual perception is the major process in reading and this is substantiated by the vast quantities of visual perception activities which are widely used in present-day developmental and corrective reading instructional programs (Lloyd, 1969).

Yet many individuals remain poor readers. Clearly something is wrong.

Is it possible that this part of our reading theory is incorrect? Could the visual-perceptual development activities be of dubious value to students? Is there

indeed the possibility that reading is less of a visual/perceptual process than presently assumed? Are students (and teachers) wasting their time in these (busy-work) activities? (Ekwall, (1976)

Statement of the Problem. The primary purpose of the present study was to test the theory that reading is a perceptual process. This was carried out by determining the relationship between student performance on an objective measure of visual/motor perception and their performance on a standardized, norm-referenced reading achievement test.

The present study was also undertaken to establish performance norms on the measure of visual-motor perception because none exist at the present time. This was the secondary purpose.

The tertiary purpose of the study was to determine the nature of performance between and among the sexes. Would there be performance differences between males and females and, if so, to what extent?

These were the guide questions used in the study:

1. What relationship exists between student performance on a standardized reading achievement test and their performance on a test of visual/motor accuracy?

    a. Do those who perform well on the reading test also perform well on the perception test?

    b. Do poor readers perform poorly on both tests?

2. What are the individual characteristics of those students who ranked as being most accurate in their performance on the test of visual/motor perception? (least accurate?)

3. What is average performance on the measure or test of visual/motor perception and what are performance parameters?

4. Do males perform better than females (are they more accurate) on the measure of visual/motor perception? That is to say, are there significant performance differences between the sexes?

Review of Related Literature. There is indeed a vast amount of experimental literature on the subject of perception (visual, auditory, and motor) probably because of the assumption that the development of these skills is an important adjunct to teaching reading. Many studies have been carried out to discover the relationships existing between measures of perception and reading achievement, but the results of these research efforts tend to be ambiguous. The experimental evidence of some studies show significant relationships existing between visual/motor perception and reading achievement, but the results of other studies show little or no such relationships.

Many well-known and respected authorities in the field of reading support the thesis that reading is a perceptual process and recommend appropriate training through the use of vast quantities of visual/perceptual/motor activities as viable supplements to the developmental and corrective reading programs for students.

Gibson and others attempted to isolate the particular factors that make for pupil ability to visually discriminate among letters of the alphabet. She noted that the accurate identification of letters involves skills that require pupils to isolate and focus on those letter features critically different from others. Her study, in which letter-like forms were used, appeared to demonstrate that normal pupils learn something that makes better letter discrimination possible. She concluded,

> . . . it is the distinctive features of grapheme patterns which are responed to in the discrimination of letter-like forms. The improvement in such discrimination from four to eight (in normal children) is the result of learning to detect these variants and becoming sensitive to them (p. 904) (Gibson, et. al.)

The implications of the Gibson study are clear, teach children to read by improving their visual perceptual abilities. And many reading specialists seem

to believe that visual skills are significantly related to word recognition. Vernon, for one, believes that students who have reading problems also have perceptual difficulties. Those readers cannot readily distinguish one letter from another, nor can they recognize significant details. Moreover, problem readers tend to be confused about the directions of letters and words (Vernon). Cohn's study substantiates the findings of Vernon. He noted that children are frequently unaware of the specific nature of some of the simplest looking letters and that even the letter d is not easily recognized (Cohn).

However, these same authorities also recognize that there are large numbers of poor readers in our schools and that relatively few students read to the maximum of their potential. They lack the necessary reading skills and the desire to perform adequately in academic areas. Vocabulary knowledge and comprehension skills as well as the need to read are inhibiting factors so if the theory is correct, why is there such poor reading achievement among these students?

Some current research casts considerable doubt on the perceptual theory. In one study it was discovered that no significant relationship exists between word recognition ability and visual discrimination skills (Larson and Hammill). In another study it was concluded that there was no relationship between word recognition skills and visual discrimination errors (Ash and Buckland). One expert is of the opinion that we really do not know how words are identified. He writes:

> The actual process by which we recognize words is not well understood, simply because the whole process of "pattern perception," as it is called, is one of the most mysterious problems in psychology. (Carroll p. 9).

From this brief review of the related literature one may draw a number of conclusions. Among them are the following:

> Many investigators have been unable to relate specific perceptual abilities to particular reading skills (Ash and Buckland)

> Few studies have been carried out to discover the special kinds of visual skills related to selected components of reading (ibid)
>
> It has not yet been determined whether the type of discrimination skills described by Gibson and others are viable in the more complex reading requirements such as word recognition. (Carroll)

The implications of these and other studies seems clear. No consistant and significant relationships have been found to substantiate the theory of reading as a perceptual process. Visual skills needed to distinguish between experimental variables such as artificial graphemes do not seem essential to pupil recognition of words. The value of placing students in learning situations specially designed to improve visual/perceptual deficiencies is questionable. The time, effort, and expense given to such training activities should be reexamined in light of these studies.

And most important of all, the theory itself is open to question.

Design of the Study. The present study was cross-sectional in nature and consisted of two testing phrases. Students in grades four, five, and six were tested with the Gates-MacGinitie Reading Survey D - Form 1. The regular classroom teachers administered the tests and then turned them over to the chief researcher's associate for scoring and tabulating. The second testing phase consisted of performance measures on the Howard-Dolman Apparatus (Lafayette Instrument Company) which is a stereopsis screening instrument. This was done to quantitatively measure the visual perception accuracy of each subject. Testing with the Howard-Dolman Apparatus and subsequent data tabulation were done by the chief researcher who assumes all responsibility for errors occurring in the study.

The Howard-Dolman Apparatus is an instrument designed to test for and measure acuity of depth perception. It is an out-growth and refinement of the Helmholtz three needle experiment (Woodworth and Schlosberg). The present apparatus,

redesigned by Howard consists of two rods suspended within an enclosed housing. The subject's task is to align the rods so they are precisely side-by-side. The subject moves the rods back and forth by means of a cord attached to rod guides. In so doing, the subject uses visual/motor sensory impressions in aligning the rods. Accuracy is measured by a centemeter scale mounted on top of the housing. A pointer indicates the distance each rod has moved away from perfect alignment. (zero error)

The housing contains its own lighting system and provides uniformly diffused illumination. The two rods are seen through an aperture from a distance of twenty feet. This design eliminates extraneous clues and requires the subject to make discriminations on the basis of binocular vision and hand-arm-finger (visual/motor) movement perception clues.

Participating teachers administered the reading test at a mutually agreed upon time so that the results of this variable would be minimized. Afterwards the chief researcher began testing with the Howard-Dolman Apparatus. This took place in a portable classroom unused except for storing supplies. The apparatus was placed at one end of the classroom and the subject was seated precisely twenty feet from it. After a brief orientation, the subject attempted to align the rods so they were side-by-side. Each subject had a total of ten trials at rod alignment and then returned to the regular classroom. After each trial, the chief research reset the rods so they were out of alignment, walked to the subject, handed over the rod alignment actuating cord, and told the subject to try again. Performance scores were recorded on the special recort sheet specially prepared for that purpose (Appendix A).

This data gathering process was begun at precisely the same time each morning, one class per day, until all classes had been tested. A final make-up day was scheduled for absentees and handled in the same time fashion.

When all data were collected, they were tabulated by the chief researcher's associate, checked by the chief researcher and then treated for significance. A two tailed t probe was used for this purpose as noted in the appropriate section below.

Upper elementary grade students (grades four, five, and six) were used in the present study because they were receiving developmental reading instruction and had matured physically so they could perform adequately on the Howard-Dolman Apparatus. Younger subjects (grades one, two, and three) were not used because they tend to lack visual/motor coordination. Their fine muscles have not yet fully developed (Olson). Older students (grades seven and above) typically do not receive development reading instruction in any of their courses. For this reason it was deemed inappropriate to include them. The population sample, therefore, included subjects who had matured in perceptual/motor skill development and who were also receiving reading instruction.

Treatment of the Data and Findings. Data were tabulated (Appendix B) and treated for the purpose of determining the significance of relationships existing between performance on the Howard-Dolman Apparatus and performance on the Gates-MacGinitie Reading Tests Survey D - Form 1. There are four subtest scores on the reading test: speed, accuracy, vocabulary, and comprehension. There are two subtest scores on the Howard-Dolman Apparatus, minus deviation and plus deviation from the mid-point of zero error in rod alignment performance. These error scores were combined to give a total error score in centimeters.

All performance data were tabulated by grade level and instrumentation. This information is presented on the ensuing tables. The first of these, TABLE I, contains information for the three fourth grades. An examination of TABLE I reveals that there were no significant differences between and among the fourth

TABLE I

FOURTH GRADE PERFORMANCE SCORES: HOWARD-DOLMAN TEST OF

VISUAL-MOTOR ACCURACY AND THE GATES-MACGINITIE READING TEST, SURVEY D

| Grade | HOWARD-DOLMAN | | | | | | GATES-MACGINITIE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Minus Error (cm) | | Plus Error (cm) | | Total Error (cm) | | Attempted | | Correct | | Vocabulary | | Comprehension | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| 4-1 (N=24) | 7.7 | 7.8 | 16.8 | 13.5 | 24.2 | 17.9 | 17.25 | 7.18 | 16.13 | 6.69 | 28.54 | 5.84 | 32.92 | 8.92 |
| 4-2 (N=27) | 7.9 | 10.9 | 14.0 | 11.0 | 21.9 | 17.5 | 17.44 | 4.21 | 16.19 | 4.57 | 30.19 | 6.24 | 30.48 | 10.02 |
| 4-3 (N=26) | 9.1 | 10.3 | 14.1 | 9.3 | 23.2 | 13.0 | 14.19 | 5.88 | 13.19 | 5.36 | 26.85 | 6.30 | 30.81 | 10.02 |
| Totals (N=77) | 8.3 | 9.7 | 14.9 | 11.3 | 23.0 | 16.0 | 16.29 | 5.94 | 15.16 | 5.67 | 28.55 | 6.21 | 31.35 | 9.62 |

grade classes. Accuracy in visual-perceptual performance on the Howard-Dolman apparatus (mean performance) is similar for the three fourth grades. The pattern of error is clearly indicated. Minus error (esophoric vision) is significantly less than positive error (exophoric vision). The implications of this phenomenon are not clear at present and warrant further investigation. In grade 4-1 the mean minus error was 7.7 cm. In grade 4-2 the error was 7.9 cm, and in grade 4-3 it was 9.1 cm. By contrast, the mean plus error in grade 4-1 was 16.8 cm, or more than twice the minus error. In grade 4-2 the plus error was 14.0 cm, or almost double the minus error. In grade 4-3 the plus error was 14.1 cm, or 6 cm. greater than the minus error.

An examination of the standard deviations for the minus scores reveals that in each fourth grade the variance was greater than the average. This is a clear indication of the non-linear nature of the visual perception task in the esophoric mode. However, if we look at the positive error scores it is clear that the standard deviations are less than the average performance error. This would seem to indicate that exophoric vision is more stable, but the mean plus error is about double that of the minus error. And this would seem to indicate greater inaccuracy in the exophoric mode. These data clearly support the growth phenomenon of initial hyperopia in young children. (See APPENDIX - C)

Pupil performance on the Gates-MacGinitie Reading Tests-Survey D show the results to be linear. Reading test scores reveal what was expected and are supported by the original norming data for those tests. This group of fourth graders performed as expected. It will be noted that students in grades 4-1 and 4-2 read at a consistently higher level than those in grade

4-3 in the number of reading rate paragraphs attempted, the number of reading rate paragraphs correct, and vocabulary knowledge. However, the differences were not significant. Students in grade 4-1 were, on the average, higher in comprehension than those in grades 4-2 and 4-3, but those differences were not significant.

In TABLE II on the following page, performance information is presented for the subjects in all fifth grade classes. Scores are similar to those in the fourth grade. That is to say, the pattern of accuracy/inaccuracy with the visual perception task is the same. An examination of TABLE II reveals the following: minus error (exophoric vision) is less error prone than is plus error, yet there is a wide variation in pupil performance. In grade 5-1 the average minus error was 6.0 cm. In grade 5-2 the error was 9.8 cm, and in grade 5-3 the error was 8.0 cm. Comparing these data with the plus error, it is apparent that exophoric performance is more inaccurate. The average plus error for students in grade 5-1 was 15.4 cm, more than twice the minus error. The average plus error for participants in grade 5-2 was 12.7 cm, or about 3 cm greater than the minus error. And the average plus error for students in grade 5-3 was 12.0 cm., or 4 cm greater than the minus error. So for the fifth grade subjects, it can be observed that the plus error, although larger than the minus error, seems to be closing the gap and becomes less for students in grades 5-2 and 5-3. The students in grade 5-1 had a plus error of more than double the minus error, a phenomenon worth further investigation.

Examining the standard deviations is the next step. A look at the standard deviation for grade 5-1 shows that it is larger than the mean performance (SD=7.7 cm: M=6.0 cm). But that pattern does not fit grade 5-2.

TABLE II

FIFTH GRADE PERFORMANCE SCORES: HOWARD-DOLMAN TEST OF VISUAL-MOTOR ACCURACY AND THE GATES-MACGINITIE READING TEST, SURVEY D

| Grade | HOWARD-DOLMAN Minus Error (cm) M | SD | Plus Error (cm) M | SD | Total Error (cm) M | SD | GATES-MACGINITIE Attempted M | SD | Correct M | SD | Vocabulary M | SD | Comprehension M | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-1 (N=21) | 6.0 | 7.7 | 15.4 | 11.1 | 22.0 | 16.4 | 25.67(1 | 8.3 | 22.81*1 | 8.1 | 30.71 | 7.6 | 32.67 | 12.4 |
| 5-2 (N=22) | 9.8 | 7.8 | 12.7 | 9.0 | 22.3 | 14.3 | 17.95(1 | 7.0 | 17.27*1 | 7.0 | 30.41 | 6.0 | 36.23 | 9.7 |
| 5-3 (N=20) | 8.0 | 10.0 | 12.0 | 9.9 | 20.0 | 15.0 | 14.50(2 | 5.7 | 14.30*2 | 5.8 | 31.15 | 8.1 | 37.25 | 10.1 |
| Totals (N=63) | 8.0 | 8.4 | 13.4 | 10.0 | 21.4 | 15.0 | 19.43 | 8.4 | 18.17 | 7.8 | 30.75 | 7.2 | 35.36 | 10.8 |

(-(1 =.02p
*-*1 =.002p

(2=.001p
*2=.001p

Here the standard deviation was 7.8 cm while the mean was 9.8 cm. However, the scores for grade 5-3 revert to the initial pattern where the standard deviation is 10.0 cm and the average error is 8.0 cm. From these data it is clear that for two of the three fifth grades the pattern of accuracy in the esophoric visual mode is similar to that of the fourth grade participants. Yet for grade 5-2 this is not so and can lead to the assumption that this phase of the visual perception task may be chronological age/visual maturity oriented. The trend may or may not be significant and must await our examination of performance scores for the sixth graders.

The plus error pattern is, again, larger than the minus error, but the standard deviations are less than the average error score. This would seem to indicate that exophoric vision is more stable, yet the mean plus error is larger than the mean minus error. However, it is less in the fifth grades than in the fourth grades,and the pattern again supports the growth phenomenon of initial hyperopia which gradually diminishes as chronological age and maturity increase.

Performance on the Gates-MacGinitie reading test did reveal significant differences between groups. Grade 5-1 scores in number of speed and accuracy paragraphs attempted was 25.67 and significantly higher than grade 5-2 (17.95) and grade 5-3 (14.50). This same phenomenon held true for the number of speed and accuracy paragraphs correctly answered. Students in grade 5-1 had 22.81 correct while grade 5-2 had 17.27 correct and grade 5-3 had 14.30 correct. There were no significant differences in vocabulary or comprehension.

In TABLE III on the following page, performance data are shown for all sixth grade participants. It will be noted that, once again, the performance scores for the Howard-Dolman apparatus are similar in pattern when compared with previous grades. It seems that the mean minus error continues to be

TABLE III

SIXTH GRADE PERFORMANCE SCORES: HOWARD-DOLMAN TEST OF VISUAL-MOTOR ACCURACY AND THE GATES-MACGINITIE READING TEST, SURVEY D

| Grade | HOWARD-DOLMAN | | | | | | GATES-MACGINITIE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Minus Error (cm) | | Plus Error (cm) | | Total Error (cm) | | Attempted | | Correct | | Vocabulary | | Comprehension | |
| | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD | M | SD |
| 6-1 (N=23) | 8.0 | 10.0 | 11.6 | 9.7 | 19.1 | 15.7 | 21.87 | 5.9 | 19.09 | 5.3 | 31.04 | 7.4 | 38.09 | 9.0 |
| 6-2 (N=26) | 8.1 | 8.5 | 11.2 | 6.4 | 19.3 | 8.1 | 23.54( | 6.4 | 22.15* | 7.0 | 34.96 | 8.5 | 42.54 | 9.8 |
| 6-3 (N=24) | 7.1 | 7.1 | 14.0 | 13.8 | 21.1 | 15.5 | 18.04( | 6.1 | 17.50* | 6.2 | 33.04 | 8.2 | 37.67 | 11.2 |
| Totals (N=73) | 7.8 | 8.5 | 12.2 | 10.3 | 19.8 | 13.3 | 21.2 | 6.5 | 19.7 | 6.4 | 33.09 | 8.1 | 39.53 | 10.2 |

(.003p
*.016p

less than the mean plus error and the standard deviation continues to be larger than the average performance. This is true, with the exception of grade 6-3. Sixth graders continued the pattern of greater accuracy in esophoric vision and greater inaccuracy with exophoric vision. However, it will be noted that students in grade 6-1 and grade 6-2 had a mean error score of 8.0 cm and 8.1 cm, respectively, and that this comes rather close to the mean plus error (11.6 cm and 11.2 cm). It would seem that the students in these classes were maturing, visually, to a point of greater equality in performance error. This, of course, supports the theory of vision stability in which young children on the average gradually outgrow hyperopia.

But such is not the case with students in grade 6-3. The average minus error is 7.1 cm with a standard deviation of 7.1 cm. The mean plus error is 14.0 cm or about double. So it is dififcult to draw conclusions from these performances because there is no significant relationship evident. However, a seminal trend may be noted in the fact that average minus error is moving closer to average plus error. Moreover, the average plus error is decreasing with successive chronological ages. Once again examining the tables shows the following: the average minus error for all fourth grades was 8.3 cm with a standard deviation of 9.7. For the fifth grades it was 8.0/8.4 and for the sixth grades it was 7.8/8.5. Clearly, the average performance was becoming more accurate with higher age levels, but the differences were not significant.

On the other hand, average plus error for all fourth grades was 14.9 cm with a standard deviation of 11.3 cm. Average fifth grade performance was 13.4/10.0 (a difference of 15 mm) and for the sixth graders it was 12.2/10.3 (a difference of 12 mm). Our statistical treatment indicates that these

differences are not significant, but the trend is clearly there. That is to say, we may suppose that students at successively higher levels of chronological age will perform with greater accuracy on the Howard-Dolman apparatus. They will do so up to an age level, as yet unknown, and then accuracy will begin to deteriorate, indicating the curvilinear nature of this task. Although there are no data to substantiate this theory, it appears to be a reasonable assumption and worthy of investigation.

Turning now to the performance scores on the Gates-MacGinitie reading tests for the sixth graders, our statistical treatment revealed that students in grade 6-2 were significantly faster than those in grade 6-3. That is to say, the pupils in grade 6-2 attempted to read a significantly higher number of speed reading paragraphs than did those students in grade 6-3. Moreover, they also had a significantly greater number of correct responses. The average number of speed and accuracy paragraphs attempted by students in grade 6-2 was 23.54, but only 18.04 for those in grade 6-2. The mean number correct for students in grade 6-2 was 22.15 and significantly greater than the 17.50 for grade 6-3 students. There were other differences as shown in TABLE III, but they were not significant.

Conclusions. Data from the present study reveal that for the population sampled the following conclusions appear to be warranted:

1. There is no relationship between performance on the Howard-Dolman Test of Visual-Motor Accuracy and the Gates-MacGinitie Reading Tests, Survey D - Form 1.

   Those who performed well on the reading test did not necessarily perform with greater accuracy on the perception test.

   Those who performed low on the reading test did not necessarily perform inaccurately on the perception test.

2. There were no discernable individual characteristics regarding those students who were most accurate or least accurate in performance on the Howard-Dolman Apparatus.

3. Average performance error was

| Grade | Mean | Standard Deviation |
|---|---|---|
| 4 | 23.0 | 16.0 |
| 5 | 21.4 | 15.0 |
| 6 | 19.8 | 13.3 |

in centimeters; deviation from the mid-point (zero error)

4. There seems to be no significant difference in accuracy of performance when the scores of the males were compared with the scores of the females. Some boys performed as accurately as some girls and some boys as inaccurately as some girls. The task does not seem to reflect differences in motor ability when boys are compared with girls.

5. These data appear to indicate that, for the subjects who participated in the present study, skill in reading and skill in visual perception are not related. Therefore, the possibility exists that visual perception training activities are not an aid to reading achievement.

Recommendations for Further Study. Data and conclusions from the present study clearly warrant further investigation. The extended research should seek answers to these questions:

1. Why is the mean minus error less than the mean plus error?
2. Why is the standard deviation for the minus error larger than the mean minus error, especially for the younger students?
3. Why is the mean plus performance error (exophoric vision) larger than the mean minus error?

4. Does the error in performance with the Howard-Dolman apparatus, indeed, decrease to some as yet undetermined minimum as chronological age increases? If so, what is the significance of this phenomenon? Students in grades seven, eight and nine should be measured to answer this question: Is performance curvilinear?

5. An in-depth study should be made of those students who performed with greatest accuracy on the Howard-Dolman apparatus and these data should be compared or contrasted with those students who performed with the least accuracy (or had the largest performance error).

In grade 4-1 this would include GM=F (61 mm/22 mm=83 mm) and LR=F (57 mm/31 mm=88 mm). In grade 4-2 this would include MD=M (52 mm/25 mm=77 mm) and KC=F (57 mm/17 mm=74 mm). In grade 4-3 this would include SC=F (26 mm/26 mm=52 mm) and LR=M (17 mm/67 mm=84 mm). And this type of classification shows that four subjects are females and only two are males, these subjects having the greatest accuracy.

In grade 5-1 this would include VK (F) and BD (M). In grade 5-2 this would include BL (F) and HG (F). In grade 5-3 this would include BS (M) and LR (F). Once again, there are four females and two males who were most accuate in their performance.

In grade 6-1 this would include WR (M) and MD (F). In grade 6-2 this would include PJ (M: 18 mm, 23 mm=41 mm, the most accurate of all subjects) and TG (M). In grade 6-3 this would include SB(F) and CL (F). Here we can see that there is an equal number of males and females.

Those who were least accurate in performance could be selected and studied to determine if there is a pattern of history or behavior which would explain their performance.

A Final Note. The present study was both exciting and frustrating. It was exciting because the initial hypothesis was supported: there is no relationship between visual perception as measured by the Howard-Dolman apparatus and reading achievement as measured by the Gates-MacGinitie Reading Tests - Survey D. It was frustrating because there was no linearity in performance on the Howard-Dolman apparatus. However, the seminal trend toward greater accuracy with higher chronological ages mandates further investigation.

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APPENDIX A

Project ARGUS - II

A Measure of Visual-Tactile Performance with the Howard-Dolman Instrument

Name _____ Grade _____ Date _____

Birthdate _____ Vision check: _____

Speed: Raw score _____ Grade score _____ Standard score _____

Accuracy: Raw score _____ Grade score _____ Standard score _____

Vocabulary: Raw score _____ Grade score _____ Standard score _____

Comprehension: Raw score _____ Grade score _____ Standard score _____

Howard-Dolman Rod Alignment Performance Grid

Indogonous - 0 + Exogonous

| | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 2. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 3. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 4. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 5. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 6. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 7. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 8. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 9. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| 10. | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |

0

Total - _____ Total + _____

Total Howard-Dolman Performance Measure _____

Remarks:

APPENDIX B

Grade 4 (1) ARGUS - G 5/9/77

| Name | | Howard-Dolman Performance | | | Gates-MacGinitie Reading Tests Survey D Form 1 | | | |
|---|---|---|---|---|---|---|---|---|
| | | Minus - | Plus + | Total T | Att. | Corr. | Voc. | Comp |
| 1. AR | M | 104 | 184 | 288 | 36 | 36 | 42 | 47 |
| 2. CC | F | 39 | 78 | 117 | 16 | 15 | 30 | 34 |
| 3. CL | F | 99 | 6 | 105 | 13 | 12 | 33 | 40 |
| 4. DP | M | 103 | 300 | 403 | 17 | 15 | 28 | 27 |
| 5. FR | M | 0 | 138 | 138 | 17 | 15 | 24 | 42 |
| 6. FC | F | 95 | 235 | 330 | 20 | 20 | 28 | 36 |
| 7. GM | F | 61 | 22 | 83 | 22 | 19 | 25 | 32 |
| 8. FB | F | 14 | 131 | 145 | 18 | 17 | 34 | 43 |
| 9. HM | M | 73 | 46 | 119 | 10 | 10 | 22 | 37 |
| 10. HS | M | 202 | 142 | 344 | 12 | 12 | 22 | 26 |
| 11. KA | M | 31 | 99 | 130 | 20 | 19 | 39 | 42 |
| 12. LR | F | 57 | 31 | 88 | 9 | 8 | 19 | 23 |
| 13. PP | F | 15 | 112 | 127 | 27 | 17 | 22 | 21 |
| 14. MM | F | 41 | 144 | 185 | 15 | 15 | 27 | 29 |
| 15. RD | M | 0 | 321 | 321 | 10 | 10 | 24 | 27 |
| 16. RT | M | 347 | 353 | 700 | 15 | 15 | 30 | 40 |
| 17. RL | F | 25 | 187 | 212 | 20 | 19 | 30 | 40 |
| 18. SR | F | 104 | 66 | 170 | 15 | 15 | 31 | 37 |
| 19. SM | M | 123 | 512 | 635 | 36 | 33 | 38 | 45 |
| 20. ST | M | 0 | 139 | 139 | 11 | 10 | 26 | 16 |
| 21. SD | M | 0 | 128 | 128 | 9 | 9 | 26 | 19 |
| 22. TD | F | 139 | 471 | 610 | 20 | 20 | 27 | 33 |
| 23. WL | F | 125 | 46 | 171 | 13 | 12 | 24 | 20 |
| 24. WJ | M | 45 | 132 | 177 | 14 | 14 | 34 | 34 |

Grade 4 (2) ARGUS - G 5/11/77

| | Name | | Visual-Tactile Performance | | | Reading Performance Gates-MacGinitie D-1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Minus - | Plus + | Total T | Att. | Corr. | Voc. | Comp. |
| 1. | AH | F | 56 | 134 | 190 | 16 | 15 | 28 | 30 |
| 2. | BD | M | 28 | 82 | 110 | 21 | 18 | 33 | 37 |
| 3. | FR | F | 117 | 140 | 257 | 12 | 12 | 35 | 35 |
| 4. | GL | F | 16 | 74 | 90 | 14 | 13 | 25 | 18 |
| 5. | HJ | F | 15 | 100 | 115 | 17 | 17 | 33 | 37 |
| 6. | HS | F | 140 | 291 | 431 | 15 | 15 | 34 | 33 |
| 7. | HL | M | 17 | 74 | 91 | 17 | 13 | 30 | 25 |
| 8. | HK | F | 0 | 184 | 184 | 9 | 9 | 22 | 20 |
| 9. | JK | F | 58 | 26 | 84 | 15 | 15 | 31 | 39 |
| 10. | JS | F | 52 | 153 | 205 | 22 | 22 | 38 | 36 |
| 11. | KC | F | 57 | 17 | 74 | 23 | 21 | 33 | 35 |
| 12. | LT | F | 25 | 117 | 142 | 15 | 15 | 36 | 39 |
| 13. | LM | F | 231 | 43 | 274 | 15 | 15 | 28 | 36 |
| 14. | LD | F | 1 | 319 | 320 | 20 | 18 | 26 | 33 |
| 15. | LJ | M | 0 | 175 | 175 | 20 | 20 | 31 | 45 |
| 16. | MD | M | 52 | 25 | 77 | 18 | 17 | 28 | 25 |
| 17. | MJ | F | 120 | 401 | 521 | 21 | 21 | 38 | 43 |
| 18. | NL | F | 25 | 75 | 100 | 20 | 20 | 22 | 24 |
| 19. | RM | M | 5 | 93 | 98 | 22 | 18 | 25 | 32 |
| 20. | SL | M | 11 | 82 | 93 | 27 | 27 | 43 | 48 |
| 21. | SJ | M | 0 | 166 | 166 | 20 | 20 | 35 | 38 |
| 22. | SC | F | 400 | 58 | 458 | 12 | 9 | 18 | 18 |
| 23. | SC | M | 47 | 131 | 178 | 18 | 10 | 22 | 14 |
| 24. | TM | M | 206 | 195 | 401 | 16 | 13 | 34 | 11 |
| 25. | WD | F | 81 | 13 | 94 | 18 | 18 | 35 | 36 |
| 26. | ZM | M | 385 | 432 | 817 | 9 | 7 | 21 | 21 |
| 27. | ZS | F | 0 | 166 | 166 | 19 | 19 | 27 | 25 |

Grade 4 (3) ARGUS - G 5/13/77

| | Name | | Visual - Tactile Performance Howard - Dolman Minus - | Plus + | Total T | Reading Performance Gates-MacGinitie D-1 Att. | Corr. | Voc. | Comp. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | AC | F | 33 | 230 | 263 | 18 | 16 | 26 | 37 |
| 2. | AS | M | 403 | 79 | 482 | 9 | 9 | 28 | 28 |
| 3. | BL | F | 74 | 53 | 127 | 9 | 9 | 27 | 30 |
| 4. | BK | F | 111 | 46 | 157 | 16 | 15 | 32 | 48 |
| 5. | BN | F | 105 | 132 | 237 | 20 | 17 | 26 | 26 |
| 6. | CM | M | 97 | 109 | 206 | 18 | 18 | 38 | 47 |
| 7. | GJ | F | 3 | 189 | 192 | 10 | 8 | 23 | 14 |
| 8. | FN | F | 14 | 182 | 196 | 9 | 7 | 29 | 29 |
| 9. | GJ | M | 148 | 70 | 218 | 13 | 13 | 33 | 36 |
| 10. | HB | M | 120 | 214 | 334 | 13 | 13 | 29 | 33 |
| 11. | HB | M | 26 | 71 | 97 | 19 | 19 | 35 | 44 |
| 12. | KB | M | 101 | 179 | 280 | 7 | 6 | 18 | 24 |
| 13. | KA | F | 16 | 251 | 267 | 12 | 12 | 23 | 28 |
| 14. | LD | F | 184 | 231 | 415 | 33 | 26 | 25 | 37 |
| 15. | LR | M | 17 | 67 | 84 | 14 | 12 | 22 | 24 |
| 16. | MD | M | 27 | 420 | 447 | 13 | 13 | 28 | 22 |
| 17. | PK | F | 83 | 89 | 172 | 19 | 19 | 27 | 37 |
| 18. | PJ | F | 111 | 32 | 143 | 14 | 13 | 22 | 18 |
| 19. | RM | M | 17 | 198 | 215 | 6 | 3 | 12 | 9 |
| 20. | SK | M | 138 | 36 | 174 | 25 | 25 | 38 | 43 |
| 21. | SR | M | 51 | 128 | 179 | 14 | 14 | 36 | 38 |
| 22. | SC | F | 26 | 26 | 52 | 10 | 10 | 23 | 28 |
| 23. | SC | F | 393 | 189 | 582 | 14 | 14 | 25 | 35 |
| 24. | TS | F | 29 | 257 | 286 | 11 | 10 | 25 | 32 |
| 25. | [illegible] | M | 9 | 103 | 112 | 9 | 9 | 17 | 16 |
| 26. | WL | F | 36 | 83 | 119 | 14 | 13 | 31 | 38 |

Grade 5 (1) ARGUS - G 5/16/77

| | Name | | Howard Dolman Scores Minus - | Plus + | Total T | Gates-MacGinitie Reading Tests Att. | Corr. | Voc. | Comp. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | AD | M | 21 | 210 | 231 | 18 | 18 | 30 | 34 |
| 2. | AS | M | 150 | 9 | 159 | 36 | 35 | 37 | 47 |
| 3. | BD | M | 24 | 39 | 63 | 27 | 19 | 25 | 21 |
| 4. | BT | F | 73 | 244 | 317 | 36 | 34 | 38 | 46 |
| 5. | BA | F | 43 | 46 | 89 | 33 | 32 | 44 | 48 |
| 6. | BD | M | 240 | 482 | 722 | 28 | 14 | 15 | 8 |
| 7. | DR | M | 10 | 148 | 158 | 36 | 34 | 36 | 29 |
| 8. | DJ | M | 26 | 90 | 116 | 36 | 33 | 40 | 42 |
| 9. | FM | M | 0 | 97 | 97 | 13 | 13 | 23 | 8 |
| 10. | GA | M | 86 | 153 | 239 | 36 | 24 | 29 | 29 |
| 11. | HM | F | 0 | 224 | 224 | 17 | 16 | 24 | 31 |
| 12. | HJ | F | 282 | 217 | 499 | 13 | 13 | 25 | 31 |
| 13. | HS | F | 9 | 151 | 160 | 26 | 25 | 37 | 48 |
| 14. | HT | M | 44 | 200 | 244 | 27 | 27 | 34 | 40 |
| 15. | LM | F | 1 | 92 | 93 | 20 | 20 | 31 | 41 |
| 16. | SJ | M | 41 | 54 | 95 | 15 | 15 | 32 | 30 |
| 17. | SD | F | 0 | 205 | 205 | 36 | 35 | 43 | 46 |
| 18. | VS | F | 30 | 99 | 129 | 23 | 14 | 20 | 17 |
| 19. | VK | F | 10 | 50 | 60 | 24 | 22 | 30 | 39 |
| 20. | VT | M | 101 | 354 | 455 | 19 | 18 | 26 | 20 |
| 21. | WJ | F | 60 | 172 | 232 | 20 | 18 | 26 | 31 |

Grade 5 (2) ARGUS - G 5/18/77

| | Name | | Howard-Dolman Scores Performance Minus - | Plus + | Total T | Gates-MacGinitie Reading Tests Survey D Form 1 Att. | Cor. | Voc. | Comp. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | AJ | M | 74 | 42 | 116 | 19 | 18 | 29 | 34 |
| 2. | BS | F | 204 | 144 | 348 | 12 | 11 | 29 | 26 |
| 3. | BJ | M | 163 | 157 | 320 | 7 | 6 | 22 | 15 |
| 4. | BL | F | 29 | 56 | 85 | 25 | 24 | 35 | 38 |
| 5. | CW | F | 54 | 54 | 108 | 18 | 18 | 35 | 41 |
| 6. | CA | M | 71 | 95 | 166 | 20 | 20 | 30 | 45 |
| 7. | CJ | M | 33 | 129 | 162 | 11 | 11 | 27 | 37 |
| 8. | CR | F | 82 | 31 | 113 | 21 | 21 | 34 | 50 |
| 9. | DS | F | 13 | 95 | 108 | 20 | 19 | 27 | 37 |
| 10. | DJ | M | 0 | 130 | 130 | 24 | 22 | 30 | 39 |
| 11. | FD | M | 186 | 257 | 443 | 26 | 26 | 42 | 47 |
| 12. | HD | M | 97 | 12 | 109 | 21 | 21 | 30 | 39 |
| 13. | HG | F | 0 | 92 | 92 | 11 | 10 | 30 | 29 |
| 14. | LJ | M | 69 | 59 | 128 | 15 | 14 | 24 | 30 |
| 15. | MS | M | 266 | 192 | 458 | 16 | 15 | 30 | 38 |
| 16. | OC | M | 0 | 174 | 174 | 36 | 35 | 44 | 46 |
| 17. | RS | F | 78 | 316 | 394 | 18 | 18 | 33 | 43 |
| 18. | SC | M | 115 | 164 | 279 | 19 | 18 | 35 | 42 |
| 19. | ST | M | 134 | 14 | 148 | 16 | 15 | 30 | 40 |
| 20. | ST | F | 245 | 348 | 593 | 15 | 15 | 23 | 30 |
| 21. | TM | M | 149 | 197 | 346 | 3 | 2 | 18 | 11 |
| 22. | ZC | F | 103 | 116 | 219 | 22 | 21 | 32 | 40 |

Grade 5 (3) ARGUS - G 5/20/77

| | Name | | Howard-Dolman Scores Performance Minus - | Plus + | Total T | Gates-MacGinitie Reading Tests Survey D Form 1 Att. | Corr. | Voc. | Comp. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | BS | F | 64 | 19 | 83 | 16 | 16 | 41 | 47 |
| 2. | BS | M | 24 | 48 | 72 | 28 | 28 | 46 | 51 |
| 3. | DB | F | 116 | 28 | 144 | 18 | 18 | 36 | 46 |
| 4. | GJ | M | 293 | 146 | 439 | 16 | 16 | 38 | 17 |
| 5. | GM | F | 26 | 132 | 158 | 17 | 17 | 25 | 36 |
| 6. | HJ | M | 11 | 77 | 88 | 18 | 18 | 35 | 51 |
| 7. | HM | F | 53 | 140 | 193 | 7 | 6 | 28 | 30 |
| 8. | HG | M | 76 | 295 | 371 | 11 | 11 | 30 | 30 |
| 9. | JL | F | 5 | 261 | 266 | 23 | 23 | 39 | 51 |
| 10. | LR | F | 17 | 57 | 74 | 17 | 16 | 33 | 44 |
| 11. | MJ | M | 15 | 216 | 231 | 8 | 8 | 20 | 26 |
| 12. | MC | F | 61 | 96 | 157 | 12 | 11 | 27 | 31 |
| 13. | MD | F | 293 | 375 | 668 | 16 | 16 | 23 | 32 |
| 14. | OZ | M | 1 | 174 | 175 | 18 | 18 | 38 | 43 |
| 15. | PA | F | 116 | 66 | 182 | 7 | 7 | 32 | 42 |
| 16. | RC | F | 287 | 7 | 294 | 10 | 10 | 20 | 29 |
| 17. | RD | M | 19 | 84 | 103 | 15 | 15 | 32 | 36 |
| 18. | ST | M | 27 | 50 | 77 | 9 | 8 | 20 | 21 |
| 19. | WS | F | 65 | 71 | 136 | 6 | 6 | 19 | 36 |
| 20. | ZM | F | 27 | 67 | 94 | 18 | 18 | 41 | 46 |

Grade 6 (1) ARGUS - G 5/23/77

| | NAME | | Visual-Tactile SCORES Performance Minus - | Plus + | Total T | Reading Performance Gates MacGinitie Survey D - Form 1 Att. | Corr. | Voc. | Comp. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | BE | F | 449 | 367 | 816 | 22 | 10 | 12 | 9 |
| 2. | BK | F | 46 | 64 | 110 | 26 | 26 | 40 | 45 |
| 3. | BD | M | 86 | 36 | 122 | 24 | 22 | 30 | 43 |
| 4. | CB | M | 33 | 85 | 118 | 36 | 18 | 21 | 30 |
| 5. | DL | F | 2 | 144 | 146 | 22 | 22 | 28 | 44 |
| 6. | FJ | F | 7 | 118 | 125 | 22 | 22 | 38 | 47 |
| 7. | GB | F | 89 | 101 | 190 | 36 | 29 | 37 | 37 |
| 8. | HJ | M | 26 | 66 | 92 | 25 | 25 | 36 | 39 |
| 9. | HL | F | 14 | 127 | 141 | 22 | 21 | 42 | 46 |
| 10. | HR | M | 14 | 151 | 165 | 18 | 18 | 39 | 35 |
| 11. | HG | M | 88 | 6 | 94 | 14 | 10 | 21 | 27 |
| 12. | MB | M | 77 | 63 | 140 | 16 | 16 | 36 | 42 |
| 13. | MD | F | 43 | 56 | 89 | 23 | 23 | 34 | 47 |
| 14. | PR | F | 5 | 147 | 152 | 25 | 13 | 28 | 32 |
| 15. | PE | M | 160 | 194 | 354 | 28 | 28 | 35 | 49 |
| 16. | SM | F | 253 | 105 | 358 | 14 | 11 | 25 | 33 |
| 17. | SD | F | 32 | 192 | 224 | 19 | 17 | 32 | 35 |
| 18. | UM | M | 64 | 72 | 136 | 17 | 17 | 36 | 45 |
| 19. | VC | F | 154 | 36 | 190 | 15 | 15 | 29 | 42 |
| 20. | WT | F | 34 | 99 | 133 | 22 | 20 | 33 | 38 |
| 21. | WR | M | 63 | 1 | 64 | 18 | 17 | 25 | 29 |
| 22. | WJ | F | 61 | 241 | 302 | 21 | 21 | 35 | 45 |
| 23. | ZM | M | 36 | 107 | 143 | 18 | 18 | 22 | 37 |

Grade 6 (2) ARGUS - G 5/25/77

| | NAME | | Howard-Dolman Performance | | | Gates-MacGinitie Reading Tests - Survey D Form 1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Minus - | Plus + | Total T | Att. | Corr. | Voc. | Comp. |
| 1. | BT | M | 1 | 141 | 142 | 24 | 23 | 26 | 36 |
| 2. | BC | F | 173 | 88 | 261 | 15 | 12 | 22 | 40 |
| 3. | CL | M | 70 | 138 | 208 | 27 | 9 | 8 | 1 |
| 4. | CA | M | 85 | 129 | 214 | 29 | 27 | 41 | 44 |
| 5. | CD | F | 26 | 98 | 124 | 20 | 19 | 31 | 43 |
| 6. | DM | F | 292 | 0 | 292 | 35 | 34 | 44 | 50 |
| 7. | GB | F | 50 | 53 | 103 | 26 | 26 | 40 | 50 |
| 8. | GD | F | 7 | 300 | 307 | 21 | 21 | 39 | 50 |
| 9. | MM | M | 22 | 136 | 158 | 30 | 28 | 36 | 39 |
| 10. | MB | F | 90 | 131 | 221 | 32 | 32 | 43 | 47 |
| 11. | MB | M | 28 | 120 | 148 | 30 | 30 | 45 | 50 |
| 12. | MT | F | 32 | 91 | 123 | 20 | 17 | 24 | 43 |
| 13. | ND | M | 241 | 131 | 372 | 16 | 16 | 36 | 48 |
| 14. | PJ | M | 18 | 23 | 41 | 19 | 19 | 36 | 43 |
| 15. | RS | F | 231 | 0 | 231 | 28 | 27 | 38 | 44 |
| 16. | RH | M | 19 | 119 | 138 | 11 | 11 | 25 | 32 |
| 17. | RK | F | 123 | 168 | 291 | 33 | 33 | 40 | 51 |
| 18. | ST | M | 233 | 51 | 284 | 20 | 20 | 40 | 47 |
| 19. | SR | F | 25 | 238 | 263 | 29 | 29 | 41 | 48 |
| 20. | SB | M | 19 | 126 | 145 | 14 | 14 | 35 | 39 |
| 21. | TG | M | 7 | 89 | 96 | 17 | 16 | 27 | 38 |
| 22. | TJ | M | 10 | 100 | 110 | 21 | 21 | 37 | 44 |
| 23. | TM | M | 83 | 80 | 163 | 21 | 20 | 35 | 44 |
| 24. | VH | F | 18 | 92 | 110 | 21 | 20 | 37 | 40 |
| 25. | WJ | F | 100 | 115 | 215 | 29 | 29 | 43 | 51 |
| 26. | WB | M | 107 | 142 | 249 | 24 | 23 | 40 | 44 |

Grade 6 (3) ARGUS - G 5/27/77

| | NAME | | Howard-Dolman Performance | | | Gates - McGinitie Reading Tests - Survey D Form 1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Minus - | Plus + | Total T | Att. | Corr. | Voc. | Comp. |
| 1. | AS | M | 51 | 51 | 102 | 16 | 16 | 29 | 40 |
| 2. | BK | F | 75 | 8 | 83 | 13 | 13 | 16 | 11 |
| 3. | BP | F | 112 | 37 | 149 | 18 | 17 | 29 | 43 |
| 4. | CL | F | 21 | 57 | 78 | 24 | 24 | 44 | 48 |
| 5. | GL | F | 0 | 431 | 431 | 18 | 18 | 38 | 40 |
| 6. | HK | F | 42 | 136 | 178 | 20 | 20 | 36 | 49 |
| 7. | HS | M | 316 | 409 | 725 | 16 | 16 | 36 | 44 |
| 8. | LM | F | 110 | 29 | 139 | 26 | 25 | 41 | 48 |
| 9. | LJ | M | 52 | 114 | 166 | 7 | 5 | 13 | 11 |
| 10. | LM | M | 0 | 170 | 170 | 18 | 18 | 41 | 43 |
| 11. | LR | M | 55 | 181 | 236 | 7 | 7 | 23 | 18 |
| 12. | MT | F | 3 | 202 | 205 | 22 | 20 | 43 | 42 |
| 13. | MK | M | 0 | 177 | 177 | 15 | 15 | 31 | 42 |
| 14. | NT | M | 49 | 479 | 528 | 22 | 21 | 40 | 46 |
| 15. | PP | F | 104 | 91 | 195 | 20 | 20 | 37 | 47 |
| 16. | PK | F | 137 | 0 | 137 | 25 | 24 | 33 | 42 |
| 17. | RJ | M | 56 | 52 | 108 | 16 | 16 | 32 | 42 |
| 18. | RA | M | 117 | 92 | 209 | 15 | 14 | 28 | 24 |
| 19. | ST | M | 51 | 60 | 111 | 16 | 16 | 27 | 35 |
| 20. | SB | F | 11 | 58 | 69 | 12 | 12 | 30 | 29 |
| 21. | SK | F | 0 | 158 | 158 | 14 | 14 | 31 | 35 |
| 22. | VD | M | 49 | 311 | 360 | 18 | 17 | 30 | 36 |
| 23. | WD | F | 138 | 34 | 172 | 19 | 16 | 41 | 47 |
| 24. | WR | M | 159 | 18 | 177 | 36 | 36 | 44 | 42 |

# APPENDIX C

```
25-MAR-78      BANK                    W E S T E R N   M I C H I G A N   U N I V E R S I T Y                    PAGE    1

              TAKEN FROM BANK: BRUCE.BNK      CREATED ON: 25-MAR-78      BY PROJECT-PROGRAMMER NUMBER  73604,  73604
```

VARIABLE: SEX  NUMBER: 1  DESCRIPTION: SEX OF STUDENT INVOLVED IN PROJECT  VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 101.0000 | SUM OF OBSERVATIONS SQUARED= 101.0000 | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 0.4741784 | MEDIAN= 0.0000000 | MODE= 0.0000000 |
| MAXIMUM= 1.000000 | MINIMUM= 0.0000000 | RANGE= 1.000000 |
| STANDARD ERROR OF MEAN= 0.3429432E-01 | STANDARD DEVIATION= 0.5005091 | VARIANCE= 0.2505093 |
| COEFFICIENT OF SKEWNESS= 0.1034244 | COEFFICIENT OF VARIATION= 105.5529 | KURTOSIS= 1.010697 |

| VALUE | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 15.0 | 30.0 | 45.0 | 60.0 | 75.0 |
|---|---|---|---|---|---|---|---|---|
| 0.000000 | 112 | 52.582 | 52.582 | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX | | | | |
| 1.000000 | 101 | 47.418 | 100.000 | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX | | | | |
| | 213 | | | 15.0 | 30.0 | 45.0 | 60.0 | 75.0 |

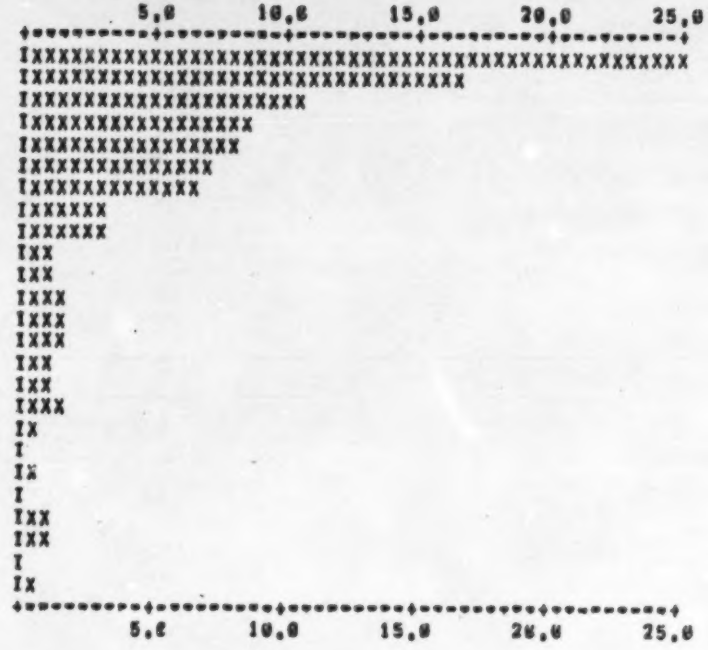
TAKEN FROM BANK: BRUCE.PNK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73684, 73684

VARIABLE: MINUS NUMBER: 2 DESCRIPTION: ON HOWARD-DOOLMAN PERFORMANCE VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 17025.00 | SUM OF OBSERVATIONS SQUARED= 3639685. | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 79.92958 | MEDIAN= 52.00000 | MODE= 0.0000000 |
| MAXIMUM= 449.0000 | MINIMUM= 0.0000000 | RANGE= 449.0000 |
| STANDARD ERROR OF MEAN= 6.097511 | STANDARD DEVIATION= 88.99825 | VARIANCE= 7919.264 |
| COEFFICIENT OF SKEWNESS= 1.843244 | COEFFICIENT OF VARIATION= 111.3358 | KURTOSIS= 6.432628 |

| VALUE | | OVER | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE |
|---|---|---|---|---|---|
| 0.0000000 | - | 17.96000 | 53 | 24.883 | 24.883 |
| 17.96000 | - | 35.92000 | 35 | 16.432 | 41.315 |
| 35.92000 | - | 53.88000 | 22 | 10.329 | 51.643 |
| 53.88000 | - | 71.84000 | 18 | 8.451 | 60.094 |
| 71.84000 | - | 89.80000 | 17 | 7.981 | 68.075 |
| 89.80000 | - | 107.7600 | 15 | 7.042 | 75.117 |
| 107.7600 | - | 125.7200 | 14 | 6.573 | 81.690 |
| 125.7200 | - | 143.6800 | 6 | 2.817 | 84.507 |
| 143.6800 | - | 161.6400 | 6 | 2.817 | 87.324 |
| 161.6400 | - | 179.6000 | 2 | 0.939 | 88.263 |
| 179.6000 | - | 197.5600 | 2 | 0.939 | 89.202 |
| 197.5600 | - | 215.5200 | 3 | 1.408 | 90.610 |
| 215.5200 | - | 233.4800 | 3 | 1.408 | 92.019 |
| 233.4800 | - | 251.4400 | 3 | 1.408 | 93.427 |
| 251.4400 | - | 269.4000 | 2 | 0.939 | 94.366 |
| 269.4000 | - | 287.3600 | 2 | 0.939 | 95.305 |
| 287.3600 | - | 305.3200 | 3 | 1.408 | 96.714 |
| 305.3200 | - | 323.2800 | 1 | 0.469 | 97.183 |
| 323.2800 | - | 341.2400 | 0 | 0.000 | 97.183 |
| 341.2400 | - | 359.2000 | 1 | 0.469 | 97.653 |
| 359.2000 | - | 377.1600 | 0 | 0.000 | 97.653 |
| 377.1600 | - | 395.1200 | 2 | 0.939 | 98.592 |
| 395.1200 | - | 413.0800 | 2 | 0.939 | 99.531 |
| 413.0800 | - | 431.0400 | 0 | 0.000 | 99.531 |
| 431.0400 | - | 449.0000 | 1 | 0.469 | 100.000 |
| | | | 213 | | |



TAKEN FROM BANK: BRUCE.BKK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

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VARIABLE: PLUS NUMBER: 3 DESCRIPTION: ON HOWARD-DOLMAN PERFORMANCE VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 28824,00 | SUM OF OBSERVATIONS SQUARED= 6263304, | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 135,3239 | MEDIAN= 115,0000 | MODE= 46,00000 |
| MAXIMUM= 512,0000 | MINIMUM= 0,0000000 | RANGE= 512,0000 |
| STANDARD ERROR OF MEAN= 7,233589 | STANDARD DEVIATION= 105,5696 | VARIANCE= 11144,94 |
| COEFFICIENT OF SKEWNESS= 1,433749 | COEFFICIENT OF VARIATION= 78,01258 | KURTOSIS= 5,830534 |

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 5.0 10.0 15.0 20.0 25.0 |
|---|---|---|---|---|---|---|
| 0,0000000 | - | 20,48000 | 15 | 7,042 | 7,042 | IXXXXXXXXXXXXX |
| 20,48000 | - | 40,96000 | 16 | 7,512 | 14,554 | IXXXXXXXXXXXXXX |
| 40,96000 | - | 61,44000 | 24 | 11,268 | 25,822 | IXXXXXXXXXXXXXXXXXXXXXX |
| 61,44000 | - | 81,92000 | 18 | 8,451 | 34,272 | IXXXXXXXXXXXXXXXX |
| 81,92000 | - | 102,4000 | 27 | 12,676 | 46,948 | IXXXXXXXXXXXXXXXXXXXXXXXX |
| 102,4000 | - | 122,8800 | 13 | 6,103 | 53,052 | IXXXXXXXXXXX |
| 122,8800 | - | 143,3600 | 25 | 11,737 | 64,789 | IXXXXXXXXXXXXXXXXXXXXXX |
| 143,3600 | - | 163,8400 | 13 | 6,103 | 70,892 | IXXXXXXXXXXX |
| 163,8400 | - | 184,3200 | 15 | 7,042 | 77,934 | IXXXXXXXXXXXXX |
| 184,3200 | - | 204,8000 | 10 | 4,695 | 82,629 | IXXXXXXXXX |
| 204,8000 | - | 225,2800 | 6 | 2,817 | 85,446 | IXXXXXX |
| 225,2800 | - | 245,7600 | 5 | 2,347 | 87,793 | IXXXXX |
| 245,7600 | - | 266,2400 | 4 | 1,878 | 89,671 | IXXXX |
| 266,2400 | - | 286,7200 | 0 | 0,000 | 89,671 | I |
| 286,7200 | - | 307,2000 | 4 | 1,878 | 91,549 | IXXXX |
| 307,2000 | - | 327,6800 | 4 | 1,878 | 93,427 | IXXXX |
| 327,6800 | - | 348,1600 | 1 | 0,469 | 93,897 | IX |
| 348,1600 | - | 368,6400 | 2 | 0,939 | 94,836 | IXX |
| 368,6400 | - | 389,1200 | 1 | 0,469 | 95,305 | IX |
| 389,1200 | - | 409,6000 | 2 | 0,939 | 96,244 | IXX |
| 409,6000 | - | 430,0800 | 1 | 0,469 | 96,714 | IX |
| 430,0800 | - | 450,5600 | 2 | 0,939 | 97,653 | IXX |
| 450,5600 | - | 471,0400 | 2 | 0,939 | 98,592 | IXX |
| 471,0400 | - | 491,5200 | 2 | 0,939 | 99,531 | IXX |
| 491,5200 | - | 512,0000 | 1 | 0,469 | 100,000 | IX |
| | | | 213 | | | 5.0 10.0 15.0 20.0 25.0 |

40

TAKEN FROM BANK: BRUCE.BNK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

VARIABLE: TOTAL NUMBER: 4 DESCRIPTION: ON HOWARD-DOLMAN PERFORMANCE VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 45712,00 | SUM OF OBSERVATIONS SQUARED= 0,1446929E+08 | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 214,6103 | MEDIAN= 166,0000 | MODE= 110,0000 |
| MAXIMUM= 817,0000 | MINIMUM= 41,00000 | RANGE= 776,0000 |
| STANDARD ERROR OF MEAN= 10,15757 | STANDARD DEVIATION= 148,2448 | VARIANCE= 21976,52 |
| COEFFICIENT OF SKEWNESS= 1,852625 | COEFFICIENT OF VARIATION= 69,07627 | KURTOSIS= 0,545599 |

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 5,0 10,0 15,0 20,0 25,0 |
|---|---|---|---|---|---|---|
| 41,00000 | - | 72,04000 | 7 | 3,286 | 3,286 | IXXXXXXX |
| 72,04000 | - | 103,0800 | 33 | 15,493 | 18,779 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 103,0800 | - | 134,1200 | 31 | 14,554 | 33,333 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 134,1200 | - | 165,1600 | 32 | 15,023 | 48,357 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 165,1600 | - | 196,2000 | 29 | 13,615 | 61,972 | IXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 196,2000 | - | 227,2400 | 16 | 7,512 | 69,484 | IXXXXXXXXXXXXXX |
| 227,2400 | - | 258,2800 | 11 | 5,164 | 74,648 | IXXXXXXXXXX |
| 258,2800 | - | 289,3200 | 10 | 4,695 | 79,343 | IXXXXXXXXX |
| 289,3200 | - | 320,3600 | 8 | 3,756 | 83,099 | IXXXXXXXX |
| 320,3600 | - | 351,4000 | 5 | 2,347 | 85,446 | IXXXXX |
| 351,4000 | - | 382,4400 | 5 | 2,347 | 87,793 | IXXXXX |
| 382,4400 | - | 413,4800 | 3 | 1,408 | 89,202 | IXXX |
| 413,4800 | - | 444,5200 | 5 | 2,347 | 91,549 | IXXXXX |
| 444,5200 | - | 475,5600 | 4 | 1,878 | 93,427 | IXXXX |
| 475,5600 | - | 506,6000 | 2 | 0,939 | 94,366 | IXX |
| 506,6000 | - | 537,6400 | 2 | 0,939 | 95,305 | IXX |
| 537,6400 | - | 568,6800 | 0 | 0,000 | 95,305 | I |
| 568,6800 | - | 599,7200 | 2 | 0,939 | 96,244 | IXX |
| 599,7200 | - | 630,7600 | 1 | 0,469 | 96,714 | IX |
| 630,7600 | - | 661,8000 | 1 | 0,469 | 97,183 | IX |
| 661,8000 | - | 692,8400 | 1 | 0,469 | 97,653 | IX |
| 692,8400 | - | 723,8800 | 2 | 0,939 | 98,592 | IXX |
| 723,8800 | - | 754,9200 | 1 | 0,469 | 99,061 | IX |
| 754,9200 | - | 785,9600 | 0 | 0,000 | 99,061 | I |
| 785,9600 | - | 817,0000 | 2 | 0,939 | 100,000 | IXX |
| | | | 213 | | | 5,0 10,0 15,0 20,0 25,0 |

TAKEN FROM BANK: BRUCE,PAK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

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VARIABLE: ATT NUMBER: 5 DESCRIPTION: GATES-MACGINTIE ITEMS ATTEMPTED VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 4026,000 | SUM OF OBSERVATIONS SQUARED= 87126,00 | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 18,90141 | MEDIAN= 18,00000 | MODE= 18,00000 |
| MAXIMUM= 36,00000 | MINIMUM= 3,000000 | RANGE= 33,00000 |
| STANDARD ERROR OF MEAN= 0,4942871 | STANDARD DEVIATION= 7,212715 | VARIANCE= 52,02325 |
| COEFFICIENT OF SKEWNESS= 0,6996016 | COEFFICIENT OF VARIATION= 38,15967 | KURTOSIS= 3,135767 |

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 5,0 10,0 15,0 20,0 25,0 |
|---|---|---|---|---|---|---|
| 3,000000 | - | 4,320000 | 1 | 0,469 | 0,469 | IX |
| 4,320000 | - | 5,640000 | 0 | 0,000 | 0,469 | I |
| 5,640000 | - | 6,960000 | 2 | 0,939 | 1,408 | IXX |
| 6,960000 | - | 8,280000 | 7 | 3,286 | 4,695 | IXXXXXXX |
| 8,280000 | - | 9,600000 | 9 | 4,225 | 8,920 | IXXXXXXXX |
| 9,600000 | - | 10,92000 | 5 | 2,347 | 11,268 | IXXXXX |
| 10,92000 | - | 12,24000 | 13 | 6,103 | 17,371 | IXXXXXXXXXXXX |
| 12,24000 | - | 13,56000 | 8 | 3,756 | 21,127 | IXXXXXXXX |
| 13,56000 | - | 14,88000 | 11 | 5,164 | 26,291 | IXXXXXXXXXX |
| 14,88000 | - | 16,20000 | 38 | 14,085 | 40,376 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 16,20000 | - | 17,52000 | 9 | 4,225 | 44,601 | IXXXXXXXX |
| 17,52000 | - | 18,84000 | 20 | 9,390 | 53,991 | IXXXXXXXXXXXXXXXXXX |
| 18,84000 | - | 20,16000 | 27 | 12,676 | 66,667 | IXXXXXXXXXXXXXXXXXXXXXXXX |
| 20,16000 | - | 21,48000 | 9 | 4,225 | 70,892 | IXXXXXXXX |
| 21,48000 | - | 22,80000 | 11 | 5,164 | 76,056 | IXXXXXXXXXX |
| 22,80000 | - | 24,12000 | 10 | 4,695 | 80,751 | IXXXXXXXXX |
| 24,12000 | - | 25,44000 | 5 | 2,347 | 83,099 | IXXXXX |
| 25,44000 | - | 26,76000 | 5 | 2,347 | 85,446 | IXXXXX |
| 26,76000 | - | 28,08000 | 9 | 4,225 | 89,671 | IXXXXXXXX |
| 28,08000 | - | 29,40000 | 3 | 1,408 | 91,080 | IXXX |
| 29,40000 | - | 30,72000 | 2 | 0,939 | 92,019 | IXX |
| 30,72000 | - | 32,04000 | 1 | 0,469 | 92,488 | IX |
| 32,04000 | - | 33,36000 | 3 | 1,408 | 93,897 | IXXX |
| 33,36000 | - | 34,68000 | 0 | 0,000 | 93,897 | I |
| 34,68000 | - | 36,00000 | 13 | 6,103 | 100,000 | IXXXXXXXXXXX |
| | | | 213 | | | 5,0 10,0 15,0 20,0 25,0 |

TAKEN FROM BANK: BRUCE.BNK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

VARIABLE: CORR NUMBER: 6 DESCRIPTION: GATES-MACGINTIE ITEMS CORRECT VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

SUM OF OBSERVATIONS= 3747.000 SUM OF OBSERVATIONS SQUARED= 75091.00 NUMBER OF OBSERVATIONS= 213
MEAN= 17.59155 MEDIAN= 17.00000 MODE= 18.00000
MAXIMUM= 36.00000 MINIMUM= 2.000000 RANGE= 34.00000
STANDARD ERROR OF MEAN= 0.4700119 STANDARD DEVIATION= 6.859598 VARIANCE= 47.05408
COEFFICIENT OF SKEWNESS= 0.6022391 COEFFICIENT OF VARIATION= 38.99371 KURTOSIS= 3.316977

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 5.0 10.0 15.0 20.0 25.0 |
|---|---|---|---|---|---|---|
| 2.000000 | - | 3.360000 | 2 | 0.939 | 0.939 | IXX |
| 3.360000 | - | 4.720000 | 0 | 0.000 | 0.939 | I |
| 4.720000 | - | 6.080000 | 5 | 2.347 | 3.286 | IXXXXX |
| 6.080000 | - | 7.440000 | 4 | 1.878 | 5.164 | IXXXX |
| 7.440000 | - | 8.800000 | 4 | 1.878 | 7.042 | IXXXX |
| 8.800000 | - | 10.16000 | 17 | 7.981 | 15.023 | IXXXXXXXXXXXXXXXX |
| 10.16000 | - | 11.52000 | 6 | 2.817 | 17.840 | IXXXXXX |
| 11.52000 | - | 12.88000 | 8 | 3.756 | 21.596 | IXXXXXXXX |
| 12.88000 | - | 14.24000 | 21 | 9.859 | 31.455 | IXXXXXXXXXXXXXXXXXXX |
| 14.24000 | - | 15.60000 | 19 | 8.920 | 40.376 | IXXXXXXXXXXXXXXXXX |
| 15.60000 | - | 16.96000 | 14 | 6.573 | 46.948 | IXXXXXXXXXXXX |
| 16.96000 | - | 18.32000 | 33 | 15.493 | 62.441 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 18.32000 | - | 19.68000 | 10 | 4.695 | 67.136 | IXXXXXXXXX |
| 19.68000 | - | 21.04000 | 24 | 11.268 | 78.404 | IXXXXXXXXXXXXXXXXXXXXXX |
| 21.04000 | - | 22.40000 | 6 | 2.817 | 81.221 | IXXXXXX |
| 22.40000 | - | 23.76000 | 4 | 1.878 | 83.099 | IXXXX |
| 23.76000 | - | 25.12000 | 8 | 3.756 | 86.854 | IXXXXXXXX |
| 25.12000 | - | 26.48000 | 4 | 1.878 | 88.732 | IXXXX |
| 26.48000 | - | 27.84000 | 4 | 1.878 | 90.610 | IXXXX |
| 27.84000 | - | 29.20000 | 6 | 2.817 | 93.427 | IXXXXXX |
| 29.20000 | - | 30.56000 | 1 | 0.469 | 93.897 | IX |
| 30.56000 | - | 31.92000 | 0 | 0.000 | 93.897 | I |
| 31.92000 | - | 33.28000 | 5 | 2.347 | 96.244 | IXXXXX |
| 33.28000 | - | 34.64000 | 3 | 1.408 | 97.653 | IXXX |
| 34.64000 | - | 36.00000 | 5 | 2.347 | 100.000 | IXXXXX |
| | | | 213 | | | 5.0 10.0 15.0 20.0 25.0 |

TAKEN FROM RANK: BRUCE.RNK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

VARIABLE: VOC NUMBER: 7 DESCRIPTION: VOCABULARY SCORE ON GATES-MACGINTIE (D= VARIABLE TYPE: FLOAT

THERE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

| | | |
|---|---|---|
| SUM OF OBSERVATIONS= 6551,000 | SUM OF OBSERVATIONS SQUARED= 213129,0 | NUMBER OF OBSERVATIONS= 213 |
| MEAN= 30,75587 | MEDIAN= 30,00000 | MODE= 30,00000 |
| MAXIMUM= 46,00000 | MINIMUM= 8,000000 | RANGE= 38,00000 |
| STANDARD ERROR OF MEAN= 0,5078728 | STANDARD DEVIATION= 7,412160 | VARIANCE= 54,94012 |
| COEFFICIENT OF SKEWNESS= -0,2129192 | COEFFICIENT OF VARIATION= 24,09999 | KURTOSIS= 2,655980 |

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 2,0 4,0 6,0 8,0 10,0 |
|---|---|---|---|---|---|---|
| 8,000000 | - | 9,520000 | 1 | 0,469 | 0,469 | IXX |
| 9,520000 | - | 11,04000 | 0 | 0,000 | 0,469 | I |
| 11,04000 | - | 12,56000 | 2 | 0,939 | 1,408 | IXXXXX |
| 12,56000 | - | 14,08000 | 1 | 0,469 | 1,878 | IXX |
| 14,08000 | - | 15,60000 | 1 | 0,469 | 2,347 | IXX |
| 15,60000 | - | 17,12000 | 2 | 0,939 | 3,286 | IXXXXX |
| 17,12000 | - | 18,64000 | 3 | 1,408 | 4,695 | IXXXXXXX |
| 18,64000 | - | 20,16000 | 6 | 2,817 | 7,512 | IXXXXXXXXXXXXXX |
| 20,16000 | - | 21,68000 | 3 | 1,408 | 8,920 | IXXXXXXX |
| 21,68000 | - | 23,20000 | 18 | 8,451 | 17,371 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 23,20000 | - | 24,72000 | 6 | 2,817 | 20,188 | IXXXXXXXXXXXXXX |
| 24,72000 | - | 26,24000 | 20 | 9,390 | 29,577 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 26,24000 | - | 27,76000 | 10 | 4,695 | 34,272 | IXXXXXXXXXXXXXXXXXXXXXX |
| 27,76000 | - | 29,28000 | 19 | 8,920 | 43,192 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 29,28000 | - | 30,80000 | 16 | 7,512 | 50,704 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 30,80000 | - | 32,32000 | 15 | 7,042 | 57,746 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 32,32000 | - | 33,84000 | 8 | 3,756 | 61,502 | IXXXXXXXXXXXXXXXXX |
| 33,84000 | - | 35,36000 | 19 | 8,920 | 70,423 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 35,36000 | - | 36,88000 | 12 | 5,634 | 76,056 | IXXXXXXXXXXXXXXXXXXXXXXXX |
| 36,88000 | - | 38,40000 | 18 | 8,451 | 84,507 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 38,40000 | - | 39,92000 | 4 | 1,878 | 86,385 | IXXXXXXXX |
| 39,92000 | - | 41,44000 | 14 | 6,573 | 92,958 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 41,44000 | - | 42,96000 | 3 | 1,408 | 94,366 | IXXXXXXX |
| 42,96000 | - | 44,48000 | 10 | 4,695 | 99,061 | IXXXXXXXXXXXXXXXXXXXX |
| 44,48000 | - | 46,00000 | 2 | 0,939 | 100,000 | IXXXXX |
| | | | 213 | | | 2,0 4,0 6,0 8,0 10,0 |

TAKEN FROM BANK: BRUCE.BNK CREATED ON: 25-MAR-78 BY PROJECT-PROGRAMMER NUMBER 73604, 73604

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VARIABLE: COMP NUMBER: 8 DESCRIPTION: COMPREHENSION SCORE ON GATES-MACGINITIE VARIABLE TYPE: FLOAT

WE WERE 213 OBSERVATIONS, WHICH INCLUDED 0 CASES OF MISSING DATA SELECTED FROM A TOTAL OF 213 OBSERVATIONS

OF OBSERVATIONS= 7528.000
N= 35.34272
IMUM= 51.00000
NDARD ERROR OF MEAN= 0.7324584
FFICIENT OF SKEWNESS= -0.7941274

SUM OF OBSERVATIONS SQUARED= 298286.0
MEDIAN= 37.00000
MINIMUM= 1.000000
STANDARD DEVIATION= 10.68988
COEFFICIENT OF VARIATION= 30.24633

NUMBER OF OBSERVATIONS= 213
MODE= 42.00000
RANGE= 50.00000
VARIANCE= 114.2735
KURTOSIS= 3.040936

| VALUE | | | FREQUENCY | PERCENTAGE | CUMULATIVE PERCENTAGE | 2.0 4.0 6.0 8.0 10.0 |
|---|---|---|---|---|---|---|
| 1.000000 | - | 3.00000 | 1 | 0.469 | 0.469 | IXX |
| 3.000000 | - | 5.00000 | 0 | 0.000 | 0.469 | I |
| 5.000000 | - | 7.00000 | 0 | 0.000 | 0.469 | I |
| 7.000000 | - | 9.00000 | 2 | 0.939 | 1.408 | IXXXXX |
| 9.000000 | - | 11.00000 | 2 | 0.939 | 2.347 | IXXXXX |
| 11.00000 | - | 13.00000 | 4 | 1.878 | 4.225 | IXXXXXXXXX |
| 13.00000 | - | 15.00000 | 2 | 0.939 | 5.164 | IXXXXX |
| 15.00000 | - | 17.00000 | 4 | 1.878 | 7.042 | IXXXXXXXXX |
| 17.00000 | - | 19.00000 | 6 | 2.817 | 9.859 | IXXXXXXXXXXXXXX |
| 19.00000 | - | 21.00000 | 4 | 1.878 | 11.737 | IXXXXXXXXX |
| 21.00000 | - | 23.00000 | 5 | 2.347 | 14.085 | IXXXXXXXXXXXX |
| 23.00000 | - | 25.00000 | 5 | 2.347 | 16.432 | IXXXXXXXXXXXX |
| 25.00000 | - | 27.00000 | 6 | 2.817 | 19.249 | IXXXXXXXXXXXXX |
| 27.00000 | - | 29.00000 | 6 | 2.817 | 22.066 | IXXXXXXXXXXXXX |
| 29.00000 | - | 31.00000 | 16 | 7.512 | 29.577 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 31.00000 | - | 33.00000 | 10 | 4.695 | 34.272 | IXXXXXXXXXXXXXXXXXXXXX |
| 33.00000 | - | 35.00000 | 9 | 4.225 | 38.498 | IXXXXXXXXXXXXXXXXXXX |
| 35.00000 | - | 37.00000 | 17 | 7.981 | 46.479 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 37.00000 | - | 39.00000 | 18 | 8.451 | 54.930 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 39.00000 | - | 41.00000 | 18 | 8.451 | 63.380 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 41.00000 | - | 43.00000 | 14 | 6.573 | 69.953 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 43.00000 | - | 45.00000 | 20 | 9.390 | 79.343 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 45.00000 | - | 47.00000 | 13 | 6.103 | 85.446 | IXXXXXXXXXXXXXXXXXXXXXXXXX |
| 47.00000 | - | 49.00000 | 19 | 8.920 | 94.366 | IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |
| 49.00000 | - | 51.00000 | 12 | 5.634 | 100.000 | IXXXXXXXXXXXXXXXXXXXXXXX |
| | | | 213 | | | 2.0 4.0 6.0 8.0 10.0 |